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藥劑對蔬菜斑潛蠅 (*Liriomyza sativae* Blanchard) (雙翅目：潛蠅科) 之藥效探討

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摘　　要

以帶蟲或不帶蟲菜豆苗 (*Phaseolus vulgaris* var. *communis* Aeschers) 浸漬法 (dipping method) 測試歐殺滅 (oxamyl SL)、阿巴汀 (abamectin EC) 及賽滅淨 (cyromazine SL, WP) 等藥劑對蔬菜斑潛蠅 (*Liriomyza sativae* Blanchard) 未成熟期與成蟲期之影響。結果得知上述三種藥劑均對蔬菜斑潛蠅具顯著之致死效果，確可供該蠅防治用。歐殺滅與阿巴汀對蔬菜斑潛蠅各蟲期之防治效能，均以卵與幼蟲期最高，致死率為 100%，其次為成蟲期。雌蟲接觸上述二種藥劑 24 小時，其間其存活率、產卵數及取食刻點數，不僅各受到 18.3～26.0、97.3～98.9 及 95.2～97.3% 之抑制，尚對雌蟲接觸藥劑 24 小時後之壽命、子代成蟲數及取食刻點數，各達 50.3～62.9、95.5～98.9 及 89.3～99.9% 之抑制。賽滅淨兩種劑型對蔬菜斑潛蠅各蟲期之防治效能，則以幼蟲期最高，致死率達 100%；卵期次之，對孵化率雖無影響，但對其後第一、二及三齡幼蟲之致死率，各為 60.6～64.0、94.2～98.2 及 100%；成蟲期受藥劑影響較低，雌蟲接觸此藥劑不同劑型 24 小時，其間藥劑對雌蟲存活率、產卵數及取食刻點數等，雖均無顯著直接影響，但對雌蟲接觸藥劑 24 小時後之子代成蟲數與取食刻點數，各達 73.9～85.2 與 73.4～75.9% 之抑制。

關鍵詞：蔬菜斑潛蠅、藥劑、蟲期、菜豆。

前　　言

蔬菜斑潛蠅 (*Liriomyza sativae* Blanchard) 在美國之番茄、芹菜及其他作物上，或在阿根廷之紫苜蓿 (*Medicago sativa* L.) 及中國之蔬菜與花卉生產上均曾造成嚴重經濟損失 (Anonymous, 2002; Pang *et al*., 2005)，亦為荷蘭與英國 A1 級之重要檢疫害

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蟲 (Anonymous, 1984)。由於斑潛蠅對化學藥劑容易產生抗藥性 (Parrella *et al*., 1984; Hara, 1986; Brodbent and Pree, 1989)，且廣效性藥劑對其寄生蜂之毒害 (Spencer, 1973)，以及防治斑潛蠅藥劑之有效期 (effective life) 僅 3 年 (Leibee, 1981) 等因素，致使斑潛蠅防治不易。針對此點，多位學者建議降低施藥頻率與劑量 (Mason *et al*., 1989) 及採取藥劑輪用 (Trumble, 1985a)，以減緩斑潛蠅抗藥性之發展。臺灣於 1995 年 2 月首次在臺中縣霧峰鄉菜豆與南投縣番茄上發現蔬菜斑潛蠅 (Wen *et al*., 1996)。由於行政院農業委員會審定植物保護手冊中，並未列有防治蔬菜斑潛蠅之推薦藥劑，所以本研究以該手冊 (Anonymous, 2007) 中推薦防治番茄斑潛蠅 (*Liriomyza bryoniae* (Kaltenbach)) 之殺蟲劑–歐殺滅溶液 (oxamyl SL)、阿巴汀乳劑 (abamectin EC)、賽滅淨溶液 (cyromazine SL) 及賽滅淨可釋性粉劑 (cyromazine WP)，與推薦濃度，於室內偵測此等藥劑對蔬菜斑潛蠅各蟲期之藥效，期能將結果提供該蠅綜合防治之參考。

材料與方法

寄主植物之栽培

每週定期浸泡菜豆種子 (*Phaseolus vulgaris* var. *communis* Aeschers) (300 粒)，在 25℃ 下經 7 小時種子吸水飽滿後，將其瀝淨，置於塑膠盤內進行催芽，期間並蓋上另一塑膠盤以保持濕度，待 14 小時種子發根後，即移種在溫室置有 3 號蛭石之穴盤 (長 36.5 cm，寬 28 cm，高 4.5 cm；30 穴) 內。每天澆水，經 10～13 天，菜豆苗發育至株高 15～20 cm，子葉 (cotyeldons) 葉寬達 7～9 cm 時，即可供室內蔬菜斑潛蠅產卵與藥劑試驗用。

斑潛蠅之採集

在雲林縣林內鄉菜豆 (*Phaseolus vulgaris* L.) 上採集被蔬菜斑潛蠅幼蟲危害之葉片，攜回室內並將被害葉放入塑膠盤內，待幼蟲化蛹，然後將蛹置入直徑 20 cm、高 22 cm 壓克力筒內，羽化成蟲後，供做飼育之蟲源。

斑潛蠅之繁殖

參照 Chien and Ku (1996) 飼育非洲菊斑潛蠅之方法，在室內 25℃ 定溫下，以溫室內培養之菜豆苗 (株高 15～20 cm、子葉寬 7～9 cm) 供蔬菜斑潛蠅產卵與幼蟲發育。

供試藥劑與豆苗浸藥之處理方法

供試藥劑　歐殺滅溶液、阿巴汀乳劑、賽滅淨溶液及賽滅淨可釋性粉劑爲供試藥劑，其使用形態、濃度、化學類別及出品公司等詳見表一。

帶蟲或不帶蟲豆苗之預備　在 25℃ 定溫下，將 120 隻蔬菜斑潛蠅已交尾雌蟲釋入內置有 30 株 (株高 15～20 cm、子葉寬 7～9 cm) 菜豆苗之繁殖網箱 (長 75 cm，寬 55 cm，高 50 cm)，經產卵 7 小時 (上午 9 點至下午 4 點) 後，將子葉內帶有卵之菜豆苗移出，並放置於溫度 25℃、相對濕度 65～85% RH 及光週期 14L：10D (上午 5 點至下午 7 點間照光) 下之室內繼續飼養，以供後述藥效試驗，包括帶有卵 (產卵後第二日) 或帶有第三齡幼蟲 (產卵後第六日) 豆苗之試驗材料。另準備未經蔬菜斑潛蠅雌蟲產卵之相同大小豆苗，做爲不帶蟲豆苗之試驗材料。所有供試之帶蟲或不帶蟲豆苗，均祇留有 2 片子葉，若有本葉 (plumule leaf) 長出均摘除之。

表一　供試藥劑種類、使用形態、濃度、化學類別及出品公司
Table 1.　Chemicals used in this study

Common names and formulation	Dilution factor	Chemical subgroup	Activity	Manufacturer
Oxamyl 10% SL	250	carbamate	Insecticide, acaricides, nematicides	Sundat (s) PTE Ltd.
Abamectin 2% EC	1000	avermectin	Insecticide, acaricides, nematicides	Syngenta Taiwan Ltd.
Cyromazine 8.9% SL	1000	triazine	Insecticide (insect growth regulator), acaricides	Syngenta Taiwan Ltd.
Cyromazine 75% WP	4000	triazine	Insecticide (insect growth regulator), acaricides	Syngenta Taiwan Ltd.

帶蟲或不帶蟲豆苗浸漬藥劑之處理　在 25℃ 下，各將子葉內帶有 70～100 粒卵之單株菜豆苗、子葉內帶有 20～30 隻第三齡幼蟲之單株菜豆苗、及不帶蟲之單株菜豆苗，齊根剪下，分別倒插浸漬在盛有稀釋藥液之 1,000 cc 塑膠杯內 1 分鐘，其後再將前述已浸藥後之豆苗，分別插入試管架上已盛水之試管內（直徑 1.5 cm、高 7 cm），待 30 分鐘，豆葉表面之藥液自然風乾形成均勻藥膜後，再距豆苗剪口 5 cm 處，以海綿片束紮，並直插入罐蓋上有圓孔（直徑 1.5 cm）之盛水塑膠罐（直徑 4 cm、高 5 cm）底部，供各項試驗用。另設浸水處理之對照組，其方法與過程與浸藥處理相同，僅豆苗浸漬藥劑時，對照組係以水替代之。

一、卵期施藥對各未成熟期之影響

於 25℃ 定溫下在帶蟲（卵）豆苗浸藥處理後之第三天，記錄第一齡幼蟲數與未孵化卵數，以計算卵之存活率。第四天起，每日記錄各齡幼蟲數、蛹數及成蟲數。另設僅浸水處理之帶蟲（卵）豆苗為對照組。每處理各做 4～6 重複。

二、第三齡幼蟲期施藥對未成熟期存活率之影響

於 25℃ 定溫下，在帶蟲（第三齡幼蟲）豆苗浸藥處理後之第二天，記錄蛹數與死亡幼蟲數，以計算藥劑對第三齡幼蟲存活率之影響。第十天起，每日記錄羽化之成蟲數，以計算藥劑對蛹存活率之影響。另設僅浸水處理之帶蟲（第三齡幼蟲）豆苗為對照組。每處理各做 4～6 重複。

三、藥劑對成蟲之影響

豆苗浸藥後接蟲 24 小時之處理　為觀測成蟲與浸藥豆苗接觸 24 小時內之存活率、產子代數及取食刻點數，乃在 25℃ 定溫下，早上 9 點將 2 日齡已交尾成蟲 10 對（羽化後第三日）釋入直徑 20 cm、高 25 cm 之壓克力筒內，除供應 2 株已浸藥處理後之不帶蟲豆苗供其產卵與取食，另以細毛筆將未稀釋純蜂蜜，塗於壓克力筒內壁，供應成蟲食用。24 小時後，僅將成蟲移出，記錄雌、雄蟲之存活數；豆苗仍留在原壓克力筒內，依 Chien and Ku (1996) 之方法，距雌蟲與藥劑接觸後之次日、第四日及第四～六日，分別記錄原浸藥豆葉上雌蟲之取食刻點數、子代卵數（未孵化卵數 ＋ 第一齡幼蟲數）及子代第一至三齡幼蟲數。另設僅浸水處理之不帶蟲豆苗為對照組。每處理各做 3～5 重複。

成蟲接觸藥劑 24 小時後存活個體之後

表二　蔬菜斑潛蠅卵經不同藥劑處理後各未成熟期之存活百分率[1)]

Table 2. Percentage survival rate of the immature stages of *Liriomyza sativae* after the eggs were treated with various insecticides[1)]

Insecticides	Egg	Larva				Pupa	Egg-pupa
		1st	2nd	3rd	total		
Oxamyl	0b[2)]	-	-	-	-	-	0b
Abamectin	0b	-	-	-	-	-	0b
Cyromazine SL	96.6 ± 1.5a	39.4 ± 4.3b	1.8 ± 1.8b	0b	0b	-	0b
Cyromazine WP	94.1 ± 2.8a	36.0 ± 2.7b	5.8 ± 2.6b	0b	0b	-	0b
CK	95.2 ± 1.1a	94.4 ± 1.9a	98.3 ± 1.0a	96.0 ± 1.4a	88.4 ± 1.3a	72.5 ± 4.8	60.8 ± 3.1a

1) Seedlings of field bean infested by 70-100 *L. sativae* eggs were dipped in an insecticide solution for 1 min. Untreated controls were dipped in distilled water. Each treatment had 4-6 replications, which contained one seedling in an individual acrylic cylinder (20 cm diameter x 25 cm high) and was placed under 25℃, 14L:10D, and 65-85% R.H. 30 min after treatment.

2) Means ($\bar{X}$ ± SEM) within each column followed by the same letter are not significantly different ($p < 0.05$, LSD). Data were transformed to arcsin$\sqrt{x}$ prior to ANOVA.

續觀察　為觀測成蟲經藥劑處理 24 小時後，對其壽命、生殖力及取食刻點數之影響，乃在上述成蟲經接觸 24 小時豆苗藥膜處理後，自活存者中隨機選取 1 對成蟲，釋入另一直徑 20 cm、高 25 cm 壓克力筒內，每日供應純蜂蜜與未經浸藥處理之 1 株不帶蟲豆苗，直至雌蟲死亡為止。然後依 Chien and Ku (1996) 之方法，計數該蠅之壽命、生殖力及取食刻點數。對照組之雌蟲，則是選自藥劑試驗中對照組之存活者。每處理各做 6～14 重複。

四、統計分析

各項試驗資料利用 SPSS (Statistical Products and Services Solutions) 軟體先進行變方分析，再以最小顯著差 (LSD) 或 *t* 值測試法檢測，並採 $p < 0.05$ 之顯著水準比較處理間之差異性。若遇百分率時，資料先進行角度轉換 (arcsine transformation)，再進行分析。

結　　果

一、卵期施藥對各未成熟期之影響

蔬菜斑潛蠅卵經三種不同藥劑與劑型處理後，除歐殺滅與阿巴汀均具 100% 殺卵效果外，賽滅淨之劑型不論是溶液或可濕性粉劑，均對卵孵化無藥效，與對照組間無顯著差異 (表二)。但若持續觀察孵化幼蟲在原浸藥處理豆葉上之發育，則發現賽滅淨溶液與可濕性粉劑兩處理，使蔬菜斑潛蠅第一、二及三齡幼蟲之存活率，各銳減為 36.0～39.4、1.8～5.8 及 0%，兩劑型間雖無顯著差異，但均與對照組呈顯著差異 (表二)。

二、第三齡幼蟲期施藥對未成熟期存活率之影響

供試之三種藥劑與劑型，均對蔬菜斑潛蠅第三齡幼蟲之化蛹有顯著之藥效，第三齡幼蟲之存活率均銳減為 0% (表三)。

三、藥劑對成蟲之影響

豆苗浸藥後接蟲 24 小時之處理　蔬菜

表三　蔬菜斑潛蠅第三齡幼蟲經不同藥劑處理後未成熟期之存活率[1)]

Table 3. Percentage survival rate of the immature stages of *Liriomyza sativae* after the third instars were treated with various insecticides[1)]

Insecticides	Percent survival		
	Larva	Pupa	Larva-pupa
Oxamyl	0b[2)]	-	0b
Abamectin	0b	-	0b
Cyromazine SL	0b	-	0b
Cyromazine WP	0b	-	0b
CK	100a	86.2 ± 2.0	86.2 ± 2.0a

1) Seedlings of field bean infested by 20-30 *L. sativae* larvae were dipped in an insecticide solution for 1 min. Untreated controls were dipped in distilled water. Each treatment had 4-6 replications, which contained one seedling in an individual acrylic cylinder (20 cm diameter x 25 cm high) and was placed under 25℃, 14L:10D, and 65-85% R.H. 30 min after treatment.

2) Means ($\bar{X}$ ± SEM) within each column followed by the same letter are not significantly different (p < 0.05, LSD). Percentage of survival data were transformed to arcsin$\sqrt{x}$ prior to ANOVA.

斑潛蠅成蟲經三種供試藥劑與劑型處理後，24 小時內，歐殺滅與阿巴汀兩藥劑，不但對雌蟲或雄蟲，各具 18.3～26.0% 或 18.4～45.8% 顯著之致死力；亦顯著降低 97.3～98.9% 雌蟲之產卵量，抑制 100% 卵之孵化率，及減少 95.2～97.3% 雌蟲之取食刻點數；同時歐殺滅對雄蟲之致死率顯著高於雌蟲 (表四)。賽滅淨兩劑型處理組中，成蟲存活率、產卵數、孵化率及取食刻點數等，雖均與對照組無顯著差異，但其子代第二與三齡幼蟲數卻顯著較對照組，各銳減 75.1 與 97.3～98.9% (表四)。

成蟲接觸藥劑 24 小時後存活個體之後續觀察　成蟲經三種供試藥劑與劑型處理 24 小時後，移至未處理藥劑之豆苗上，記錄其壽命、生育力及取食刻點數。結果顯示不論雌、雄蟲壽命，歐殺滅與阿巴汀處理組各較對照組顯著減少 46.7～62.9 與 50.3～55.7%，而賽滅淨兩劑型處理組卻與對照組無顯著差異；同時各處理組中雌、雄壽命均無顯著差異 (表五)。生殖力方面，歐殺滅與阿巴汀處理組對子代第三齡幼蟲數、蛹數及成蟲數之影響最大，各顯著較對照組減少 96.1～99.2%、95.7～99.1% 及 95.5～98.9%；賽滅淨兩劑型處理組次之，顯著較對照組各減少 75.8～85.2%、73.5～84.6% 及 73.9～85.2% (表五)。子代雌性比方面，各藥劑處理與對照組間無顯著差異 (表五)。取食刻點數方面，歐殺滅與阿巴汀處理組對雌蟲取食刻點數之影響最大，顯著較對照組減少 89.3～99.9%；賽滅淨兩劑型處理組次之，顯著較對照組各減少 73.4～75.9% (表五)。

討　論

一、藥劑類型對蔬菜斑潛蠅防治之影響

藥劑防治害蟲時，因藥劑化學類型 (chemical subgroup)、作用機制之不同，對害蟲防治效果亦不同。本試驗供試之三種藥劑各屬於不同之化學類型，如歐殺滅為氨基甲酸鹽類 (carbamate) 之殺蟲劑、殺蟎劑及殺線蟲劑，阿巴汀為土壤微生物代謝產物 (avermectin) 之殺蟲劑、殺蟎劑及殺線蟲劑，賽滅淨為昆蟲生長調節劑 (insect growth regulator) 之殺蟲劑與殺蟎劑 (表一)。前二種

表四　蔬菜斑潛蠅成蟲經不同藥劑處理後 24 小時內之存活率、子代數及取食刻點數 1)

Table 4. Percentage survival rate, progeny and feeding stipples of *Liriomyza sativae* adults treated with various insecticides within 24 hours1)

Insecticides	n	Percent survival of adult		No. progeny/10 females					Percent survival of egg	No. feeding stipples/ 10 females
		Female	Male	Egg	Larva			Pupa		
					1st	2nd	3rd			
Oxamyl	5	74.0 ± 2.4Ab2)	52.0 ± 3.7Bc	5 ± 1b	0b	0c	-	0b	0b	50 ± 12b
Abamectin	5	81.7 ± 4.8Ab	78.3 ± 5.4Ab	2 ± 0b	0b	-	-	-	0b	28 ± 3b
Cyromazine SL	4	100Aa	95.0 ± 2.9Aa	150 ± 28a	141 ± 27a	46 ± 7b	2 ± 1b	0b	99.5 ± 0.2a	967 ± 170a
Cyromazine WP	3	98.0 ± 2.0Aa	98.0 ± 2.0Aa	181 ± 14a	179 ± 13a	46 ± 3b	5 ± 1b	0b	99.1 ± 0.4a	1265 ± 164a
CK	5	100Aa	96.0 ± 4.0Aa	186 ± 13a	185 ± 13a	185 ± 13a	185 ± 13a	185 ± 13a	99.7 ± 0.3a	1048 ± 121a

1) Seedlings of field bean were dipped in an insecticide for 1 min. Untreated controls were dipped in distilled water. Each treatment contained two seedlings in an individual acrylic cylinder (20 cm diameter x 25 cm high). Thirty minutes after treatment, 10 pairs of 2-day old *L. sativae* adults were released into the cylinder and placed under 25°C, 14L:10D, and 65-85% R.H.

2) Means ($\bar{X}$ ± SEM) of percent survival of adult followed by the same uppercase letter denote that there are no significant differences between sexes ($p < 0.05$, *t*-test). Means ($\bar{X}$ ± SEM) within each column followed by the same lowercase letter are not significantly different ($p < 0.05$, LSD). The percentage of survival data was transformed to arcsin $\sqrt{x}$ prior to ANOVA.

表五　蔬菜斑潛蠅成蟲經不同藥劑處理 24 小時後之壽命、生殖力及取食刻點數1)

Table 5. The longevity, fecundity and feeding stipples of *Liriomyza sativae* adults treated with various insecticides after 24 hours1)

Insecticides	n	Longevity (d)		Fecundity/female			Female proportion	No. feeding stipples/female
		Female	Male	No. 3rd instars	No. pupae	No. adults		
Oxamyl	10	5.3 ± 0.4Ab2)	6.5 ± 0.5Ab	1 ± 1c	1 ± 1c	1 ± 1d	-	1 ± 1c
Abamectin	14	7.1 ± 1.2Ab	5.4 ± 0.5Ab	5 ± 3c	5 ± 3c	4 ± 3cd	0.56 ± 0.04a	100 ± 48c
Cyromazine SL	10	11.1 ± 0.6Aa	11.3 ± 0.8Aa	31 ± 5b	31 ± 5b	23 ± 4b	0.54 ± 0.04a	248 ± 35b
Cyromazine WP	13	11.5 ± 0.6Aa	9.3 ± 1.0Aa	19 ± 2b	18 ± 2b	13 ± 1bc	0.52 ± 0.04a	225 ± 33b
CK	6	14.3 ± 1.2Aa	12.2 ± 2.1Aa	128 ± 18a	117 ± 20a	88 ± 14a	0.46 ± 0.03a	932 ± 83a

1) For every replicate, one pair of 3-day old *L. sativae* adults that had survived after 24 h of insecticide treatment was placed in the acrylic cylinder (20 cm diameter x 25 cm high) under 25°C, 14L:10D, and 65-85% R.H. Untreated field bean seedlings were provided every day.

2) Means ($\bar{X}$ ± SEM) of longevity followed by the same uppercase letter denote that there are no significant differences between sexes ($p < 0.05$, *t*-test). Means ($\bar{X}$ ± SEM) within each row followed by the same letter are not significantly different ($p < 0.05$, LSD).

藥劑對昆蟲之作用機制爲胃毒或神經毒或接觸毒，因此歐殺滅與阿巴汀均對蔬菜斑潛蠅兼具 100% 殺卵與幼蟲效果。而賽滅淨對昆蟲與蟎之作用機制，則爲抑制其幾丁質之合成與生長調節，因而在該蠅卵期施藥時，賽滅淨之兩種劑型不但均無殺卵效果，且第一、二及三齡幼蟲之死亡率係隨發育而陸續增加；但若在該蠅第三齡幼蟲期施藥時，賽滅淨兩種劑型對幼蟲之死亡率均高達 100%。

二、藥劑對蔬菜斑潛蠅蟲期之藥效

綜合三種供試藥劑對蔬菜斑潛蠅各蟲期之防治程度中，歐殺滅與阿巴汀均以卵與幼蟲期最高，防治率高達 100%，成蟲期次之；而

賽滅淨兩種劑型則以幼蟲期最高，防治率高達100%，卵期次之，成蟲期再次。

三、藥劑對蔬菜斑潛蠅之防治效力

供試之三種藥劑因對蔬菜斑潛蠅幼蟲具高達 100% 之致死率，且各處理間無顯著差異，因而此三種藥劑均可推薦該蠅防治用。但若考慮成蟲之取食刻點與幼蟲食痕對寄主植物苗期之影響，防治蔬菜斑潛蠅之最佳藥劑，則為歐殺滅與阿巴汀，其次者為賽滅淨。Poe *et al*. (1978)、Waddill (1978)、Trumble and Toscano (1983) 及 Trumble (1985b) 等曾建議當使用一種藥劑防治斑潛蠅前，應先測試該藥劑對其寄生蜂種類之影響，並據此作為使用該藥劑之參考。Chien *et al*. (2007a, b) 亦證實防治非洲菊斑潛蠅 (*Liriomyza trifolii* (Burgess)) 之有效藥劑雖有六種，但其中僅賽滅淨與其兩種重要寄生蜂–異角釉小蜂 (*Hemiptarsenus varicornis* (Girault)) 與華釉小蜂 (*Neochrysocharis formosa* (Westwood)) 間之相容性大。底比斯釉小蜂 (*Chrysocharis pentheus* (Walker)) 與岡崎釉小蜂 (*Closterocerus okazakii* (Kamijo)) 為蔬菜斑潛蠅本地種之有效寄生蜂 (Chien and Chang, 2007, 2008a, b, 2009a, b)，所以若考慮上述藥劑對蔬菜斑潛蠅本地寄生蜂之影響，仍需進一步試驗。

四、藥劑對蔬菜斑潛蠅致死能力外之影響

Robb 與 Parrella (1984) 與 Chien *et al*. (2007a) 曾測試昆蟲生長調節劑 (insect growth regulator, IGR) 施用在非洲菊斑潛蠅幼蟲或成蟲後，確對其成蟲之生殖力具亞致死之影響 (sublethal effect)。本試驗則證實歐殺滅與阿巴汀對蔬菜斑潛蠅成蟲，除有直接致死之影響外，尚對成蟲接觸藥劑 24 小時後之壽命、生殖力及取食刻點數等，具亞致死影響。而賽滅淨之兩種劑型，雖對該蠅成蟲無直接致死之影響，但對成蟲接觸藥劑 24 小時後之生殖力與取食刻點數，卻具亞致死影響。

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Effect of Common Insecticides on *Liriomyza sativae* Blanchard (Diptera: Agromyzidae)

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ABSTRACT

Seedlings of field bean (*Phaseolus vulgaris* var. *communis* Aeschers) with and without the leaf miner (*Liriomyza sativae* Blanchard) were used to study the effects of three insecticides (oxamyl SL, abamectin EC, cyromazine SL, and cyromazine WP) against the different life stages of *L. sativae* by dipping method. The results showed that all these insecticides have a significant lethal effect on *L. sativae* and can be used to control the leaf miner. The highest lethal effect of oxamyl and abamectin was recorded for the egg and larval stages with a survival rate of 0%, and the second most effective period was the adult stage. The adult-24-hour survival rate, the number of eggs and number of feeding stipples were reduced by 18.3-26.0, 97.3-98.9 and 95.2-97.3%, respectively, and the longevity, adult progeny and the number of feeding stipples after 24 hours also decreased by 50.3-62.9, 95.5-98.9 and 89.3-99.9%, respectively. The highest lethal effect of the two cyromazine formulations was recorded for the larval stage with a survival rate of 0%; the second most effective period was the egg stage, although hatching was not affected, while the larval mortality of the 1st, 2nd and 3rd instars was 60.6-64.0, 94.2-98.2 and 100%, respectively. The least affected was the adult stage with no direct effect on the adult-24-hour survival rate and the number of eggs and number of feeding stipples. However, the adult progeny and the number of feeding stipples after 24 hours decreased by 73.9-85.2 and 73.4-75.9%, respectively.

Key words: *Liriomyza sativae*, insecticide, stages, field bean

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